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ABSTRACT

Two instructional techniques, Teams-Games-Tournament (TGT), and Student Teams-Achievement Divisions (STAD), contain a team component and a comparison-among-equals component. To separate the effects of these two components on academic performance, mutual attraction, and student attitudes, a 2 x 2 factorial design was used, varying reward structure (teams vs. individual) and comparison group (entire class vs. achievement division). The Comparison-among-equals component was operationalized by an achievement division system in which student scores on twice-weekly quizzes were compared to those of other students with similar past performance. The 207 subjects, seventh graders in eight english classes, were assigned to 4-5 member heterogeneous teams, according to students' past performance and sex. Four categories of dependent variables were measured: behavioral observation, academic achievement, attitudes, and sociometric measures. Results indicated positive team effects on percent of time-on-task, motivation, liking of others, number of classmates named as friends, peer support for academic performance, and students' feelings that their success did not depend on luck. Positive achievement division effects were found on percent of time-on-task, feeling of being liked, liking of others, number of classmates named as friends, and peer support for academic performance. There were no academic achievement effects for either factor. In conclusion, the team component had more or larger effects on mutual attraction and student attitudes than the comparison among equals; however, it was not possible to determine the relative importance of these components for increasing academic performance. (Author/CP)

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Baltimore, Maryland

Introductory Statement

The Center for Social Organization of Schools has two primary objectives: to develop a scientific knowledge of how schools affect their students, and to use this knowledge to develop better school practices and organization.

The Center works through three programs to achieve its objectives. The Policy Studies in School Desegregation program applies the basic theories of social organization of schools to study the internal conditions of desegregated schools, the feasibility of alternative desegregation policies, and the interrelation of school desegregation with other equity issues such as housing and job desegregation. The School Organization program is currently concerned with authority-control structures, task structures, reward systems, and peer group processes in schools. It has produced a large-scale study of the effects of open schools, has developed the Teams-Games-Tournament (TGT) instructional process for teaching various subjects in elementary and secondary schools, and has produced a computerized system for school-wide attendance monitoring. The School Process and Career Development program is studying transistions from high school to post secondary institutions and the role of schooling in the development of career plans and the actualization of labor market outcomes.

This report, prepared by the School Organization program, examines the separate effects of student teams and achievement divisions on students' academic performance, mutual attraction, and attitudes.

Abstract

This study assesses the independent effects of 4-5 member, heterogeneous learning teams and achievement divisions, a method of student evaluation that compares individual scores with those of a homogeneous comparison group. Two hundred seven students in eight English classes served as subjects. The experiment used a 2 x 2 (team vs. individual reward, achievement divisions vs. comparison with entire class) factorial design. Results indicated positive team effects on percent of time on-task, motivation, liking of others, number of classmates named as friends, peer support for academic performance, and student feelings that their success did not depend on luck. Positive achievement division effects were found on percent of time on-task, feeling of being liked, liking of others, number of classmates named as friends, and peer support for academic performance. No academic achievement effects were found for either factor.

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The American classroom is firmly based on a competitive-individualistic model. Students work independently and are usually evaluated in comparison to one another. This system has been assailed for many years (see, for example, Kirschenbaum, Simon, and Napier, 1971), but has remained the standard instructional model because no practical alternatives have been able to document more positive effects on academic performance and social growth.

However, recent research has been conducted on a family of classroom techniques that have been more effective than traditional methods in increasing students' academic performance and social growth. There are student team learning techniques, instructional methods in which students work in small groups and are rewarded based on the success of the group in teaching its members academic material. Team techniques have had positive effects as compared to control treatments on academic performance (Note 1; Lucker, Rosenfield, Sikes, and Aronson, 1976; Note 2; Note 3) mutual concern (Aronson, Blaney, Sikes, Stephan, and Snapp, 1975; Note 1), self-esteem (Aronson et al., 1978; Blaney, Stephan, Rosenfield, Aronson, and Sikes, 1977), and increased interracial friendship (Note 4; Slavin, in press a).

Two of the most successful student team techniques have been those developed at The Johns Hopkins University: Teams-Games-Tournament, or TGT (Note 1), and Student Teams-Achievement Divisions, or STAD (Note 3; Note 5). Both of these techniques involve procedures which equalize the probability of success given maximum effort for all students of all levels of past achievement. In TGT, this procedure is part of a "tournament" in which students compete as individuals to contribute points to their team

scores. The highest three students in past performance compete with each other; the next three compete with each other, and so on. A standard number of points are awarded to the first place winner in each of these three-person competitions, so each student has the same chance (about one in three) of contributing the maximum score to his or her team. This is in contrast to the situation in traditional classes, where some students cannot hope to make A's or B's no matter how hard they try, while others can hardly avoid making high grades.

The same function is carried out in STAD by an Achievement Division system, in which student scores on twice-weekly quizzes are compared to the scores of others of similar past performance. The highest ranking score among that group of equals earns maximum points, again regardless of whether the comparison group is one of high or low past achievement.

Thus, both TGT and STAD contain a team component and a comparison-among-equals component. This study was designed to separate the effects of these two components on academic performance, mutual attraction, and student attitudes. This comparison is accomplished by means of a 2 x 2 factorial design, where one factor is team reward vs. individual reward, and the other is a comparison with equals vs. comparison with whole class. The comparison with equals component is operationalized as the Achievement Divisions of STAD.

A long tradition of research has established the effect of team rewards on mutual attraction, positive attitudes toward the group task, and group member support for group goals (See Johnson and Johnson, 1974; Slavin, in press b). In addition, when group members are individually accountable for their performance, team reward systems usually increase performance (Slavin, in press b).

In this study, positive team effects are predicted for mutual attraction, attitudes toward school, incentive value of success, and peer support for academic performance. Because the team procedures do involve individual accountability, effects are also predicted for academic performance, percent of time on-task, and motivation.

Atkinson (1958) and others have described motivation to perform a task as the product of the probability of success at a task and the incentive value of that task to the individual. Slavin (Note 6) has extended this model to the prediction of maximum effort to the degree that the probability of success given maximum effort (P_s/Max) is greater than the probability of success given minimum effort (P_s/Min), holding incentive value of success constant. The Achievement Division is constructed to maximize the difference between P_s/Max and P_s/Min for all students by rewarding students based on the rank of their quiz scores among a comparison group comparable in past achievement. Clifford (1971) used a similar system and found greater performance in the equal comparison group than in an unequal comparison group or an individual reward condition. The Achievement Division, or comparison with equals treatment is thus expected to increase academic performance, percent of time on-task, perceived probability of success, motivation, satisfaction with school, and the degree to which students feel that academic success depends on their own performance (rather than luck).

Method

Subjects

Subjects were 205 seventh grade students in eight intact English classes in the principal town of a rural Maryland county. All but three students were white. Four teachers administered the treatments.

Experimental Design

The study used a 2 x 2 factorial design, varying reward structure (team vs. individual) and comparison group (entire class vs. Achievement Division). Each of the four teachers taught two classes. The teachers and classes were assigned to treatments in a counter-balanced fashion to distribute teacher effects equally across the main effects. This design is illustrated in Figure 1.

Insert Figure 1 About Here

Treatments

All eight classes studied the same curriculum on the same schedule every day for ten weeks. The curriculum was a unit on language mechanics, covering grammar, punctuation, and usage. All classes followed a regular schedule of teaching (30 minutes), student worksheet work (40 minutes) and quiz (20 minutes). This 2½ period cycle was repeated twice each week. The experimental manipulations took place only during the worksheet periods; the teacher presentations and quizzes were the same for all classes.

1. Team Reward, Achievement Divisions. This treatment is Student-Teams-Achievement Divisions, or STAD (Note 3; Note 5). Students were assigned to 4-5 member teams that were heterogeneous on students' past performance and sex. Teammates were assigned adjacent seats during all activities. The function of the team was to prepare its members for the quiz. Team members were encouraged to work together during the worksheet periods to help each other learn the academic material. However, students took the quizzes individually. The quiz scores received by

students were transformed by means of the Achievement Division system outlined below, and were then added into a team score. A weekly newsletter prepared by the teacher recognized the successful teams and the team members who had contributed the greatest number of points to their team score.

The Achievement Division is a means of insuring each student a roughly equal and substantial probability of success if he or she exerts maximum effort. Initially, the highest six students as determined by academic achievement were assigned to Division 1, the next six to Division 2, and so on. The students' scores on the two weekly quizzes were summed and then compared to the scores received by the other members of their division. The highest scorer earned eight points for his or her team; the second scorer earned six points; third scorer four points; and all others two points. The high scorer in each division was then "bumped" to the next higher division, where competition was likely to be more difficult. This procedure maintained the equality within the divisions over time, and corrected mistakes in initial assignment. Students did not interact with others in their divisions in any way, and were informed only of their own divisional placement.

2. Team reward, comparison with entire class. This treatment was identical to Treatment 1, above, except that team scores were formed from the simple sum of the members' quiz scores (number of items correct). The weekly newsletter recognized successful teams and individuals who earned high scores.

3. Individual Reward, Achievement Divisions. Students worked individually at all times, but received a newsletter recognizing those who had done well in the divisional competition for high scores.

4. Individual Reward, Comparison with Entire Class. Students worked individually, and received standard percentage scores on their quizzes.

Dependent Measures

Four categories of dependent variables were measured. They are as follows:

Behavioral Observation. During the last five weeks of the project, behavioral observation of students was conducted in all classes. An observer was trained to an interobserver reliability of .90 with the experimenter to note whether students were 1) on or off-task; 2) if on-task, working with a peer or alone; and 3) if off-task, interacting with a peer or not. Observations were made only during worksheet periods, and all other observations (such as interaction with staff, out of seat with permission, or otherwise not expected to be on-task) were excluded from the analysis. Thus, the analysis is restricted to students' "task opportunities," periods during which on-task behavior was clearly expected. The observer observed each student in sequence for five seconds, sweeping the class several times in an observation period. Dependent variables were percent of time on-task and percent of time on-task spent interacting with peers.

Academic Achievement. Academic achievement was measured on two separate tests, the Hoyum-Sanders Junior High School English Test (standardized) and a treatment-specific test covering the academic material taught in class. Parallel forms of both tests were given as pre- and posttests. In addition, scores on the twice-weekly quizzes in the last three weeks of the program were used as academic achievement measures. The standardized and treatment-specific achievement variables

were analyzed using their respective pre-tests as covariates, and the quiz scores were controlled for Hoyum-Sanders pretest.

Attitudes. Eight 4-5 item attitude scales adapted from the Learning Environment Inventory (Walberg and Anderson, 1968) were administered as pre- and posttests. They were satisfaction, motivation, feeling of being liked, liking of others, peer support for academic performance (e.g., "other students care whether I do well or not in this class"), and perceived probability of success (e.g., "If someone does well in this class, it is because they worked hard."). All scales were presented in a Likert-type format, where students were asked to strongly disagree, disagree, agree, or strongly agree with various statements. The scales were analyzed using their pretests as covariates.

Sociometric Measures. Students were asked to name their classmates who were their "best friends in this class" and those who have "helped you with your classwork." Twenty-four spaces were provided for each question, and students were allowed to name as many classmates as they wished. The dependent variables of interest were the number of friends and the number of helpers named by each student, taken to be an indicator of mutual attraction and peer tutoring, respectively. Both of these measures were analyzed using their pretests as covariates.

Results

The behavioral observation results were analyzed using 2 x 2 x 2 chi square contingency tables. For percent of time on-task, the factors were reward level vs. comparison group vs. on-task/off-task; for percent of time interacting with peers the factors were reward level vs. comparison group vs. peer interaction/individual work. All other variables were

analyzed using a general linear model approach analagous to analysis of covariance, in which the incremental R^2 due to treatment was tested for statistical significance (see Kerlinger and Pedhazur, 1973). Because of the counterbalanced design, interaction effects were completely confounded with teacher effects. However, only two interaction effects significant at the .10 level or above were discovered, interactions between reward level and comparison group on the percent of time on-task and percent of time peer tutoring measures.

Insert Table 1 About Here

Table 2 summarizes the behavioral observation results. The table shows that the team classes were on-task significantly more than the individual classes ($\chi^2(1)=37.08$, $p<.001$). Not surprisingly, the team classes peer tutored far more than the individual classes ($\chi^2(1)=191.85$, $p<.001$). The achievement division classes were on-task significantly more than the entire class comparison classes ($\chi^2(1)=4.61$, $p<.05$), but the entire class comparison classes peer tutored more than the Achievement Division classes ($\chi^2(1)=8.56$, $p<.01$). This second effect, which was not expected, is due to a large difference between the frequency of tutoring in the individual reward, entire class comparison group (44 % of task opportunities) and the individual reward, achievement division groups (24.4% of task opportunities). The team and achievement division effects thus support the experimental hypotheses for percent of time on task. The peer tutoring effect in favor of the entire class comparison was not expected, but is probably due to the fact that the Achievement Divisions are, after all, a competitive reward structure. Because

students did not know which students were in their divisions, they were possibly reluctant to tutor anyone for fear that their own rank in their division would suffer.

Insert Table 2 About Here

Table 2 presents the academic achievement results. None of the three measures of academic achievement showed any significant differences between treatments. Thus, the expectations of positive team and Achievement Division effects on academic achievement were not supported.

Insert Table 3 About Here

Table 3 summarizes the results of the eight attitude scales and the two sociometric questions. The numbers in parentheses after each scale name indicate the number of items in the scale. Questionnaire items were coded as follows: Strongly disagree = 1; disagree = 2; agree = 3; strongly agree = 4. Of course, negatively scoring items were reversed. The table shows no treatment effects for satisfaction and incentive value of success. Team effects were found for motivation ($F(1,203) = 3.92$, $p < .05$), liking of others ($F(1,203) = 12.80$, $p < .01$), peer support for academic performance ($F(1,203) = 20.58$, $p < .001$) perceived probability of success ($F(1,203) = 3.26$, $p < .10$) and dependence of outcome on performance ($F(1,203) = 4.28$, $p < .05$). In addition, team effects were found on the number of friends ($F(1,203) = 4.80$, $p < .05$) and number of helpers ($F(1,203) = 2.88$, $p < .10$) named. Thus, the predictions of team effects for two of the three mutual concern variables, liking of others and number of friends named, were supported, as were the predictions of

team effects for motivation and peer support for academic performance. In addition, unanticipated team effects were found for probability of success and dependence of outcome on performance.

Statistically significant Achievement Division effects were found for four variables for which effects were not anticipated, feeling of being liked ($F(1,203) = 5.95$, $p < .05$), liking of others ($F(1,203) = 4.02$, $p < .05$), peer support for academic performance ($F(1,203) = 4.40$, $p < .05$), and number of friends named ($F(1,203) = 4.02$, $p < .05$). On the other hand, Achievement Division effects were found for none of the scales for which effects were anticipated (perceived probability of success, satisfaction, motivation, and dependence of outcome on performance.) This surprising result could be a "halo effect," merely reflecting general positive attitudes, but the lack of effects on satisfaction and motivation makes this explanation doubtful.

Discussion

In summary, the expected effects of teams on academic performance were only partially supported. Participation in the team treatments increased the percentage of time students spent on task, but did not increase their academic achievement on weekly quizzes or final tests. On the other hand, the predicted team effects on mutual concern, peer norms supporting academic performance, and motivation were supported.

Except for the effect on percent of time on task, none of the predicted Achievement Division effects were found, but there were unanticipated positive effects on mutual concern variables and peer support for academic performance. Because these effects are difficult to explain parsimoniously, it seems prudent to wait for further study to

clarify them. Further, the fact that the effects on the variables that should have been influenced by Achievement Divisions (principally perceived probability of success and motivation) did not appear, suggests that the subjects' perceptions of the Achievement Division treatment varied considerably from that assumed by the experimenter. Could the students have seen the Achievement Division treatment as non-graded, rather than fairly graded? Could the Achievement Divisions have influenced teachers' perceptions of students, thereby influencing their behavior in some unexplained way? Only future research will tell.

The primary conclusion to be drawn from this study is that the team component, as opposed to the comparison among equals, is the most important component of student team techniques. Even where team and Achievement Division effects were found on the same variable, the team effects were almost always larger. However, because neither team nor Achievement Division effects were found on academic achievement, this study does not determine the relative importance of these components for increasing achievement. That is, while the teams and divisions treatment has been shown to increase academic achievement more than control in other studies (Note 3; Note 5), we still do not know which component accounts for these effects.

Finally, this study demonstrates once again the powerful effects of teams on social variables such as mutual concern and peer support for academic performance. For the practitioner, these may be the most important effects of all. These effects have been put to good use in special settings particularly in need of greater mutual concern, such as schools for disturbed adolescents (Slavin, 1977) and integrated

schools (Note 4). However, we should not ignore the possible benefits that cooperative team interventions could have on the socialization of all children. This study joins a long list of evidence that team interventions can achieve such benefits while educating as well or better than traditional instruction.

TABLE 1: BEHAVIORAL OBSERVATION

	Comparison with Entire Class		Comparison with Equals	
	Individual Reward	Team Reward	Individual Reward	Team Reward
% of task opportunities on-task	72.8	92.4	82.2	92.8
% of task opportunities peer tutoring	44.1	84.3	24.4	80.1

On-Task:

χ^2 (Reward x comparison x on-off task) = 3.28, $p < .10$

χ^2 (Reward x on-off task) = 37.08, $p < .001$

χ^2 (Comparison x on-off task) = 4.61, $p < .05$

Peer tutoring:

χ^2 (Reward x comparison x peer tutoring) = 4.99, $p < .05$

χ^2 (Reward x peer tutoring) = 191.85, $p < .001$

χ^2 (Comparison x peer tutoring) = 8.56, $p < .01$

TABLE 2: F RATIOS FOR ACADEMIC ACHIEVEMENT

	FACTOR	
Measure:	Reward	Comparison
Standardized Test	1.05	< 1
Treatment Specific Test	< 1	1.47
Quiz Scores	1.36	< 1

d.f. = 1,203

TABLE 3: F RATIOS FOR QUESTIONNAIRE SCALES AND SOCIOMETRIC MEASURES

	FACTOR	
Questionnaire Scale:	Reward	Comparison
Satisfaction (5)	< 1	< 1
Motivation (5)	3.92*	1.20
Probability of Success (4)	3.26*	< 1
Incentive Value of Success (4)	< 1	< 1
Dependence of Outcome on Performance (4)	4.28**	< 1
Feeling of Being Liked (5)	2.09	5.95**
Liking of Others (5)	12.80***	4.02**
Peer Support for Academic Performance (5)	20.58***	4.40**
Sociometric Measure:		
Number of Friends Named	4.80**	4.02**
Number of Helpers Named	2.88*	1.71

d.f. = 1,203

* $p < .10$

** $p < .05$

*** $p < .01$

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